

MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE. Assistant Editor: FRANK OWEN STETSON.

VOL. XXXIII.

FEBRUARY, 1905.

No. 2

INTRODUCTION.

The MONTHLY WEATHER REVIEW for February, 1905, is based on data from about 3583 stations, classified as follows:

Weather Bureau stations, regular, telegraph, and mail, 176; West Indian Service, cable and mail, 4; River and Flood Service, regular 52, special river and rainfall, 363, special rainfall only, 98; voluntary observers, domestic and foreign, 2565; total Weather Bureau Service, 3258; Canadian Meteorological Service, by telegraph and mail, 33; Meteorological Service of the Azores, by cable, 2; Meteorological Office, London, by cable, 8; Mexican Telegraph Company, by cable, 3; Army Post Hospital reports, 18; United States Life-Saving Service, 9; Southern Pacific Company, 96; Hawaiian Meteorological Service, 1; Jamaica Weather Service, 130; Costa Rican Meteorological Service, 25.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; Lieut. Commander H. M. Hodges, Hydrographer, United States Navy; H. Pitier, Director of the Physico-Geographic Institute, San José, Costa Rica; Commandant Francisco S. Chaves, Director of the Meteorological Service of the Azores, Ponta Delgada, St. Michaels, Azores; W. N. Shaw, Esq., Secretary, Meteorological

Office, London; H. H. Cousins, Chemist, in charge of the Jamaica Weather Office; and Señor Enrique A. Del Monte, Director of the Meteorological Service of the Republic of Cuba.

Attention is called to the fact that at regular Weather Bureau stations all data intended for the Central Office at Washington are recorded on seventy-fifth meridian or eastern standard time, except that hourly records of wind velocity and direction, temperature, and sunshine are entered on local standard time. As far as practicable, only the seventy-fifth meridian standard of time, which is exactly five hours behind Greenwich time, is used in the text of the REVIEW. The standards used by the public in the United States and Canada and by the voluntary observers are believed to conform generally to the modern international system of standard meridians, one hour apart, beginning with Greenwich. The Hawaiian standard meridian is 157° 30', or 10^h 30^m west of Greenwich. The Costa Rican standard meridian is that of San José, 5^h 36^m west of Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are sometimes corrected to agree with the eastern standard; otherwise, the local standard is mentioned.

Barometric pressures, whether "station pressures" or "seal-level pressures," are now reduced to standard gravity, so that they express pressure in a standard system of absolute measures.

FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

Over the British Isles the pressure was generally low from the 1st to the 3d, on the 9th, and from the 17th until the close of the month, and relatively high from the 4th to 8th, and 10th to 16th. The most important storm over the eastern Atlantic occurred on the 26th, 27th, and 28th, when gales with barometer readings below 29.00 inches were reported from several coast stations in Ireland and Scotland. Over southwestern Europe and the Azores high pressure prevailed throughout the month. In the higher latitudes of the western North Atlantic pressures were generally low, except from the 4th to 6th, and 19th to 22d. Between Bermuda and the south Atlantic coast pressures were relatively high, except on the 10th and from the 23d to 28th.

The storms that visited the Atlantic coast of the United States during the month were not remarkable, although one that traversed northern New England on the 13th, and another that moved from the North Carolina coast to Nova Scotia from the 25th to 27th caused winds of considerable strength. Ample warning of these storms was given.

A number of storm centers, attended by snow and high winds on the Great Lakes, passed through Canada near the boundary of the United States. A barometric depression of considerable energy, whose center passed between Hudson Bay and the lower Lakes during the 17th and 18th, caused high winds and heavy snow in the lower Lake region. Many railroads in that section were taxed to the utmost to clear away the drifts, and traffic was greatly delayed.

The Gulf and north Pacific coasts were unusually free from storms. On the evening of the 1st a storm center appeared

off Eureka, Cal., moved inland, and for nearly a week pursued a very erratic course through Nevada, southern California, Arizona, and Utah until on the 7th it passed into Colorado, and thence eastward (Chart II, Ia). This storm was accompanied by heavy rains in the Southwest, a remarkable phenomenon for the season in that usually dry region.

The precipitation of the month was above normal in the southwest and southeast, and below normal in the northeastern, northwestern and central portions of the country.

From the Rocky Mountains to the Atlantic coast the month showed remarkable and at some points unprecedented departures from normal temperatures, and at points in the Mississippi and Ohio valleys and the Southwest the departures below the monthly averages exceeded 12°. The average temperature for the three winter months at Washington, D. C., was 29°, the lowest on record since 1855-56, the next lowest, 29.4°, being the mean of 1903-4. The harbors of the North Atlantic States were in many cases blockaded by ice, and where actual blockades did not exist floating ice caused considerable trouble. The first half of February was continuously cold, and several well-defined cold waves swept over the country. The most severe cold was generally experienced from the 11th to the 14th. The following are among the minimum temperatures that attended the cold wave of the dates named: St. Paul, Minn., -26°; Chicago, Ill., -18°; Kansas City, Mo., -22°; Pueblo, Colo., -26°; Santa Fe, N. Mex., -4°; Roswell, N. Mex., -26°; Dodge, Kans., -20°; Amarillo, Tex., -8°; Palestine, Tex., 6°; New Orleans, La., 18°; Memphis, Tenn., zero; St. Louis, Mo., -18°; Pittsburg, Pa., -6°; Albany, N. Y.,

—8°; Washington, D. C., 4°; Charleston, S. C., 20°; Atlanta, Ga., 2°; Jacksonville, Fla., 26°. In connection with this and other cold waves of the month, warnings issued by the Weather Bureau permitted protective measures whereby considerable loss to fruits and tender vegetation in the Gulf States and Florida was avoided. The prevailing type of weather conditions changed materially about the middle of the month, and frequent alternations of cold to warm and vice versa were the rule in northern districts. In northeastern districts cold weather continued with few interruptions until the end of the month. On the Pacific coast temperatures were generally above the normal throughout the month.

NEW ENGLAND FORECAST DISTRICT.

The month was marked by continuously low temperature, the daily means ranging from 3° to 6° below the normal, and by deficient precipitation, the amounts ranging from 25 to 50 per cent below the normal. The storm of the 12-13th was the most severe of the month, high easterly winds and gales prevailing along the New England coast. The other disturbances were mostly accompanied by offshore or westerly winds. Warnings were issued in advance of all storms. While shipping suffered little delay from storms, it was at a standstill from ice blockades during several days of the first decade in many of the New England harbors. According to newspaper accounts, not for nearly sixty years have such conditions obtained. During the first week of the month Buzzards Bay was frozen over from side to side and almost the entire distance from New Bedford to Elizabeth Islands. The upper part of the bay was closed to navigation, the lamps at three light-houses were extinguished, and ice boats sailed over the harbor. At Nantucket the ice embargo was the worst since 1857. Navigation in Boston Harbor was much impeded by floating ice, though immense floes such as blockaded other harbors did not appear here.—*J. W. Smith, District Forecaster.*

CENTRAL FORECAST DISTRICT.

The most noteworthy features of the month were the remarkably severe weather—rain, snow, sleet, and intense cold—during the first half, and the mild, dry weather prevailing during the latter half of the month. There were two periods of severe conditions due to snow, sleet, or rain, followed by very low temperatures, the first running from the 3d to the 8th, and the second from the 12th to the 13th of the month. During these periods railroad and telegraphic facilities were badly hampered. The first week of the month was very cold, but the severest cold wave occurred from the 13th to the 16th, when temperatures of zero and below were registered throughout the district. Cold-wave warnings were issued February 1, 10, 11, and 12, all of which were fully justified.—*F. J. Walz, District Forecaster.*

NORTH-CENTRAL FORECAST DISTRICT.

The weather was extremely cold during the first half of the month, the first sixteen days being the coldest period of that length in February in the history of the Weather Bureau at many stations in this district. There was a gradual breaking up of the cold by the middle of the month, and during the last twelve days mild conditions prevailed. There was no general cold-wave warning issued, as the weather was cold at the opening of the month, and there was no material change until the general breaking up. There were no exceptionally heavy snowstorms, although the total amount for the several storms was considerable. Traffic on steam railways was delayed during the severe weather because the intense cold rendered difficult the generation of steam in boilers. The forecasts were closely watched by the railroad managers and by shippers of perishable goods, who were informed in advance of the approach of moderate temperatures so that they might hurry forward delayed orders. The winter navigation was continued by several lines, but was often much delayed by ice fields. Advisory messages were sent in advance of the storms

to the open ports of Lake Michigan on several occasions, and no casualties were reported.—*H. J. Cox, Professor and District Forecaster.*

WEST GULF FORECAST DISTRICT.

High northerly winds, for which warnings were issued, occurred along the Gulf coast on the 12th. Unseasonably low temperatures were experienced, especially from the 11th to the 14th, when this section was visited by the severest cold wave since 1899. The temperature fell to zero over the northern portion of the district and to 18°, or below, along the Gulf coast. Warnings were issued advising the public to prepare for low temperature whenever such was likely to injure vegetation, and, notwithstanding the low temperatures recorded, a large amount of tender vegetation was protected and carried through in good condition. Indications are that vegetable crops properly protected will come in nearly as early as usual. The press comments on the work of the Weather Bureau in issuing warnings were very favorable.—*I. M. Cline, District Forecaster.*

ROCKY MOUNTAIN FORECAST DISTRICT.

During the first twelve days of the month precipitation was almost continuous in the lower half of the Plateau region, and for a part of the time on the eastern slope. The snowfall was very heavy in parts of the Mountain region, while the rainfall was the greatest on record for February in southeastern Arizona, and exceeded the normal annual amount along the western border of the Territory. The precipitation during this period was accurately forecast. The stormy conditions attended a low area whose center was constantly shifting from one part to another of the middle Plateau and southern California, finally effecting a passage across the Continental Divide on the 8th. As regards temperature, the low area whose development began in the Southwest on the 9th proved the most important of the winter. For the cold wave that followed, warnings were sent on the 11th to Utah, western Colorado, western New Mexico, and the following morning to northern Arizona, and continued for parts of New Mexico. The cold was severe; at Lay, in northwestern Colorado on the morning of the 12th, the temperature reached —47°, the lowest on record in the State. Frost, notice of which had been sent out twenty-four hours in advance, was reported in south-central Arizona on the mornings of the 12th and 13th. The latter half of the month was generally mild, with precipitation in New Mexico and Arizona.—*F. H. Brandenburg, District Forecaster.*

NORTH PACIFIC FORECAST DISTRICT.

There were no storms of consequence in the North Pacific States up to the 18th, when a short period of stormy weather set in and extended to the 23d. The remainder of the month was mild, pleasant, and free from storms. The precipitation was deficient in all sections, and at the close of the month the amount of snow in the mountains was much less than is usual at the close of February. Cold-wave warnings were issued to all stations east of the Cascade Mountains on the morning of the 10th, announcing the approach of a cold wave which reached its maximum severity on the morning of the 12th, with temperatures considerably below zero in eastern Oregon, eastern Washington, and Idaho. In the western portions of the district the temperatures fell to between 15° and 17° above zero.—*A. B. Wollaber, Acting District Forecaster.*

SOUTH PACIFIC FORECAST DISTRICT.

The month was an unusually pleasant one and singularly free from the gales and southeast storms which are customary at this time of the year. The month was, however, abnormal in the matter of rainfall in the Valley of the Colorado. In southeastern California, Arizona, southern Idaho, and southern Nevada, or what may be called the arid region, the rainfall for February varied from four to seven inches, which was more than twice the amount for the same time in northern California, Oregon, and Washington. It will also be noted that during

cold-wave periods east of the Rocky Mountains, areas of low pressure seem to develop over the Southwest. The month began with general rains. On the 3d thunderstorms were reported in southern California, with high southerly winds, and this showery condition continued until the 6th. On the 10th cold-wave warnings were issued for Winnemucca, Carson City, and Red Bluff, and on the 11th for Independence. Frost warnings were issued on the 11th for the morning of the 13th, thus giving forty-eight hours warning. Thin ice was noted at San Francisco on the morning of the 12th and heavy to killing frosts occurred generally in the State on the 13th. If any damage resulted it was not due to lack of warning.—*A. G. McAdie, Professor and District Forecaster.*

RIVERS AND FLOODS.

At the end of January, owing to the great depth of the snow over the greater portion of the country and the enormous quantities of ice in the rivers, there were well-founded fears of danger and disaster from flood, should there come a sudden thaw accompanied by warm and heavy rains. The snow line extended into the northern portions of the Gulf States, and over the principal river valleys the snow ranged from six to twenty inches in depth. At the same time there were eleven inches of ice as far south as Cairo and rather more in New York and Pennsylvania. Very fortunately, however, low temperatures prevailed almost continuously and evaporation and slow melting under the sun's rays by day steadily but slowly decreased the mass of snow and ice, any unusual decrease being prevented by the nightly freezing. Not much was lost during the first half of the month, but during the second half the sun's influence was more pronounced and at the end of the month the snow line had receded to the district extending from the upper Mississippi Valley eastward. There had also been some decrease in the thickness of the ice, although dangerous gorges persisted in the Ohio, Mississippi, and the rivers of the Middle Atlantic States. As compared with the corresponding date of 1904 there was less snow and ice in the upper Mississippi and Missouri rivers, but rather more in the East. The ice gorges in the Ohio, while not so extensive as those of the preceding year, were, nevertheless, of considerable magnitude and a source of much apprehension, it being apparent that they could not go out without causing considerable damage. At Cincinnati a gorge was formed on the 2d, and on the 4th people were crossing on the ice. On the 11th warning was issued that the ice would shortly move, and on the next day it started down, causing some damage to boats, etc., but soon stopped a short distance below. On the 13th the river had closed again and there were great gorges at Medoc Bar and North Bend. On the 24th the gorge at Maysville broke, and on the 28th the ice again started at Cincinnati but soon stopped, causing a sudden fall of about ten feet in the water, and leaving a number of steamboats and other craft stranded.

At Louisville the gorge moved at times, but navigation was seriously impeded throughout the month.

At Cairo navigation southward was resumed on the 15th, and the ice gorge in the Mississippi began to move out on the 28th.

In the Mississippi, at St. Louis, there were from one to thirteen feet of ice on the 13th, and dynamite was used to keep an open channel, but with partial success only; on the 26th the ice began to move and warnings were issued that a general breaking up was probable within a very short time. The break took place on the following day, with some minor disasters to river craft. On the 28th the last of the ice passed out and the ferry boats resumed their trips.

At Memphis navigation was resumed on the 10th, ceased on the 13th, and was again resumed on the 17th. The ice disappeared on the 20th.

At Chattanooga, on the Tennessee River, navigation was resumed on the 2d, and at Nashville, on the Cumberland, on the 6th.

At Riverton, Va., on the Shenandoah, the ice was seventeen inches in thickness on the 18th, the ice field extending for a distance of ten miles both north and south. Some gorges in the Potomac were also threatening, but no damage had been done at the close of the month.

There were two moderate freshets in the Tennessee. Both were well forecast, and neither caused any damage. At Florence, Ala., 70,000 cross-ties were taken out on the rises.

Heavy rains on the 12th and 13th, and again on the 20th and 21st, over the Pedee and Wateree watersheds, caused rapid rises to stages from one to seven feet above the danger lines. Warnings that were issued on the 13th and 21st were the means of saving a large amount of property. A number of roads and bridges were destroyed, and some cattle pasturing in the swamps were drowned, the water reaching them before they could be collected.

Danger-line stages were also reached in the eastern North Carolina rivers on the 22d and 23d, for which warnings were issued on the 20th and 21st.

The heavy rains of the 12th and 13th caused freshets in the lower portions of the Oconee and Ocmulgee rivers, and danger-line stages were general below Dublin and Macon, Ga. At Abbeville, Ga., the Ocmulgee River was above the danger line of eleven feet from the 14th until the 25th, inclusive, with a crest stage of 15.8 feet on the 18th and 19th. Warnings were issued on the 12th; they were very timely and accurate, and were of the greatest benefit to all interests concerned. Reports received show that property to the amount of at least \$200,000 was saved by the warnings. In the Apalachicola system the stages were also from two to nine feet above the danger lines.

The rains from the 7th to the 10th, inclusive, necessitated several warnings for the Coosa and Alabama rivers; the stages reached were within a fraction of a foot of those forecast, and property of the value of \$75,000 was saved. The stages of the Alabama River were from three to four feet above the danger lines.

About the same time warnings of a similar character were issued for the Black Warrior and lower Tombigbee rivers, and were well verified. At Demopolis, Ala., a stage of 55.4 feet, 20.4 feet above the danger line, was reached on the 18th, and the stage remained above 50 feet from the 13th to the 27th, inclusive. The first warnings were issued on the 10th from the new district center at Meridian, Miss., for the Chickasawhay, Leaf, and Pascagoula rivers, and additional ones on the 12th. The flood stages reached ranged from three feet above the danger line on the Pascagoula to fifteen feet on the upper Chickasawhay.

The highest and lowest water, mean stage, and monthly range at 275 river stations are given in Table VI. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfield, Professor.*